CLAIMS

1. Solid oxide fuel cell including a cathode, an anode and at least one electrolyte membrane disposed between said anode and said cathode, wherein said anode comprises a cermet including a metallic portion and an electrolyte ceramic material portion, said portions being substantially uniformly interdispersed, said metallic portion having a melting point equal to or lower than 1200°C; said cermet having a metal content higher than 50 wt%, and a specific surface area equal to or lower than 5 m^2/g.

2. Solid oxide fuel cell according to claim 1 wherein the metallic portion is selected from a single metal such as copper, aluminum, gold, praseodymium, ytterbium, cerium, and alloys comprising one or more of these metals together.

3. Solid oxide fuel cell according to claim 2 wherein the metallic portion is copper.

4. Solid oxide fuel cell according to claim 1 wherein the metallic portion has a melting point higher than 500°C.

5. Solid oxide fuel cell according to claim 1 wherein the metal content ranges between 60 wt% and 90 wt%.

6. Solid oxide fuel cell according to claim 1 wherein the cermet has a specific surface area equal to or lower than 2 m^2/g.

7. Solid oxide fuel cell according to claim 1 wherein the cermet has a porosity equal to or higher than 40%

8. Solid oxide fuel cell according to claim 1 wherein the ceramic material has a specific conductivity equal to or higher than 0.01 S/cm at 650°C.

9. Solid oxide fuel cell according to claim 8 wherein the ceramic material is selected from, doped ceria and $La_{1-x}Sr_xGa_{1-y}Mg_yO_{3-\delta}$ wherein x and y are comprised between 0 and 0.7 and δ is from stoichiometry.

10. Solid oxide fuel cell according to claim 9 wherein ceria is doped with gadolinia or samaria.

11. Solid oxide fuel cell according to claim 1 wherein the ceramic material is yttria-stabilized zirconia.

12. Solid oxide fuel cell according to claim 1 wherein the cathode comprises a metal selected from platinum, silver, gold and mixtures thereof, and an oxide of a rare earth element.

13. Solid oxide fuel cell according to claim 1 wherein the cathode comprises a ceramic selected from

- $La_{1-x}Sr_xMnO_{3-\delta}$, wherein x and y are independently equal to a value comprised between 0 and 1, extremes included and δ is from stoichiometry; and

- $La_{1-x}Sr_xCo_{1-y}FeyO_{3-\delta}$, wherein x and y are independently equal to a value comprised between 0 and 1, extremes included and δ is from stoichiometry.

14. Solid oxide fuel cell according to claim 13 wherein the cathode comprises doped ceria.

15. Solid oxide fuel cell according to claim 1 wherein the cathode comprises a combination of materials as from claims 12 and 13.

16. Solid oxide fuel cell according to claim 1 wherein the electrolyte membrane is selected from yttria-stabilized zirconia, $La_{1-x}Sr_xGa_{1-y}MgyO_{3-\delta}$ wherein x and y are comprised between 0 and 0.7 and δ is from stoichiometry, and doped ceria.

17. Method for producing energy comprising the steps of:

a) feeding at least one fuel into an anode side of a solid oxide fuel cell comprising

- an anode including a cermet comprising a metallic portion and an electrolyte ceramic material portion, said portions being substantially uniformly interdispersed, said metallic portion having a melting point equal to or lower than 1200°C; said cermet having a metal content higher than 50 wt%, and a specific surface area equal to or lower than 5 m^2/g;
- a cathode, and
- at least one electrolyte membrane disposed between said anode and said cathode;

b) feeding an oxidant into a cathode side of said solid oxide fuel cell; and

c) oxidizing said at least one fuel in said solid oxide fuel cell, resulting in production of energy.

18. Method according to claim 17 wherein the solid oxide fuel cell operates at a temperature ranging between 400°C and 800°C.

19. Method according to claim 18 wherein the solid oxide fuel cell operates at a temperature ranging between 500°C and 700°C.

20. Method according to claim 17 wherein the fuel is hydrogen.

21. Process for preparing a solid oxide fuel cell including a cathode, an anode and at least one electrolyte membrane disposed between said anode and said cathode, wherein said anode comprises a cermet including a metallic portion and an electrolyte ceramic material portion; said process comprising the steps of:

- providing a cathode;

- providing the at least one electrolyte membrane; and

- providing an anode

wherein the step of providing the anode includes the steps of:

a) providing a precursor of the metallic portion, said precursor having a particle size ranging between 0.2 μm and 5 μm;

b) providing the electrolyte ceramic material having a particle size ranging between 1 μm and 10 μm;

c) mixing said precursor and said ceramic material to provide a starting mixture;

d) heating and grinding said starting mixture in the presence of at least one first dispersant;

e) adding at least one binder and at least one second dispersant to the starting mixture from step d) to give a slurry;

f) thermally treating said slurry to provide a pre-cermet;

g) reducing the pre-cermet to provide the cermet.

22. Process according to claim 21 wherein the slurry resulting from step e) is applied on the electrolyte membrane.

23. Process according to claim 21 wherein the precursor of the metallic portion is an oxide.

24. Process according to claim 23 wherein the oxide is a copper oxide.

25. Process according to claim 23 wherein the oxide is CuO.

26. Process according to claim 21 wherein the precursor has a particle size ranging between 1 and 3 μm.

27. Process according to claim 21 wherein the ceramic material has a particle size ranging between 2 and 5 μm.

28. Process according to claim 21 wherein step d) is carried out more than one time.

29. Process according to claim 21 wherein the at least one first and second dispersants are selected from ethanol and isopropanol.

30. Process according to claim 21 wherein the at least one first dispersant is the same of the at least a second dispersant.

31. Process according to claim 21 wherein the binder is soluble in the at least a second dispersant.

32. Process according to claim 21 wherein the binder is polyvinylbutyral.

33. Process according to claim 21 wherein step f) is carried out at a temperature ranging between 700°C and 1100°C.

34. Process according to claim 33 wherein step f) is carried out at a temperature ranging between 900°C and 1000°C.

35. Process according to claim 21 wherein step g) is carried out at a temperature ranging between 300°C and 800°C.

36. Process according to claim 35 wherein step g) is carried out at a temperature ranging between 400°C and 600°C.

37. Process according to claim 21 wherein step g) is performed with hydrogen containing from 1 vol.% to 10 vol.% of water.

38. Process according to claim 37 wherein hydrogen contains from 2 vol.% to 5 vol.% of water.

39. Cermet including a metallic portion and an electrolyte ceramic material portion, said portions being substantially uniformly interdispersed, said metallic portion having a melting point equal to or lower than 1200°C; said cermet having a metal content higher than 50 wt%, and a specific surface area equal to or lower than 5 m^2/g.